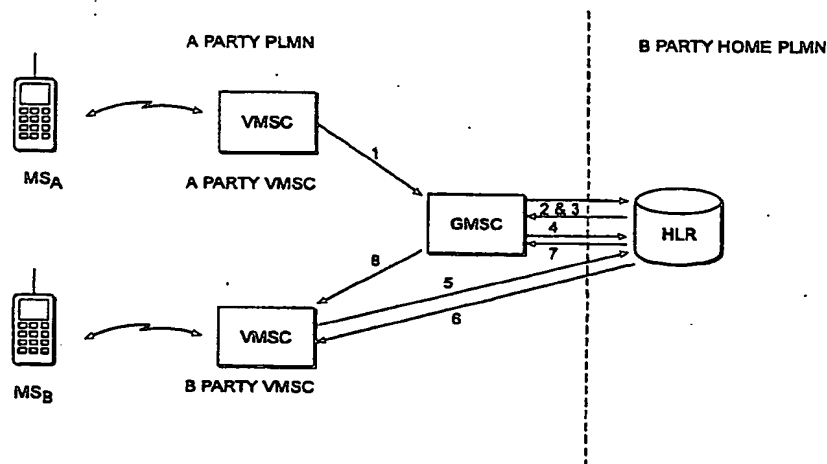




INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification ⁶ : H04Q 7/38, 7/22	A1	(11) International Publication Number: WO 97/08912 (43) International Publication Date: 6 March 1997 (06.03.97)
(21) International Application Number: PCT/FI96/00447 (22) International Filing Date: 20 August 1996 (20.08.96) (30) Priority Data: 953937 22 August 1995 (22.08.95) FI (71) Applicant (for all designated States except US): NOKIA TELECOMMUNICATIONS OY [FI/FI]; Upseerinkatu 1, FIN-02600 Espoo (FI). (72) Inventor; and (75) Inventor/Applicant (for US only): HUOTARI, Seppo [FI/FI]; Harakankuja 6 E 33, FIN-02600 Espoo (FI). (74) Agent: OY KOLSTER AB; Iso Roobertinkatu 23, P.O. Box 148, FIN-00121 Helsinki (FI).		(81) Designated States: AL, AM, AT, AU, AZ, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the</i> <i>claims and to be republished in the event of the receipt of</i> <i>amendments.</i>

(54) Title: OPTIMAL ROUTING OF A MOBILE-TERMINATING CALL**(57) Abstract**

In an optimal routing, a mobile-terminating call is routed from the PLMN of the A party directly to the PLMN currently visited by the B party (MS_B). According to the invention, in order to avoid double allocation of roaming numbers in the optimal routing, the A party PLMN first requests information on the location of the B party (2, 3). Only if it is detected, on the basis of this location information, that the optimal routing is allowed will the actual routing information request be carried out (4, 7), which causes a roaming number to be allocated for the call in the visited network (5, 6). If it is decided that optimal routing be not carried out, but the call is routed to the B party home network, the routing information request will not be carried out until at the home network. In the second embodiment of the invention, routing information requests are carried out as in the prior art, but the A subscriber PLMN mobile communication network causes the release of the roaming number thus allocated if it decides not to carry out optimal routing and routes the call to the home network.

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Optimal routing of a mobile-terminating call

Field of the Invention

The present invention relates to optimal routing of
5 a mobile-terminating call in a mobile communication
network.

Background of the Invention

Modern mobile communication systems offer a new,
appealing feature: roaming between a multitude of
10 operationally independent public land mobile networks
(PLMN). Roaming between PLMNs in different countries is
referred to as international roaming. Normally, a mobile
subscriber has a subscriber relationship with a single
PLMN. This specific PLMN is referred to as the home PLMN
15 of the mobile subscriber. Depending on e.g. subscriber
conditions, service can also be obtained in other PLMNs.
For example, a mobile subscriber for a national PLMN in
Finland, may also make outgoing calls and receive incoming
calls in another PLMN for example in Germany if there is
20 an agreement between the two PLMN operators. The second
PLMN is sometimes referred to as a visitor PLMN. An
example of a standardized system supporting international
roaming is the Pan-European digital mobile communication
system GSM and a modification thereof, DCS1800 (Digital
25 Communication System). The GSM system supports both MS-
roaming (MS, Mobile Station), in which the mobile station
roams from one PLMN to another, and SIM-roaming in which
only the subscriber's subscriber identity module (SIM)
roams. The latter also enables roaming between PLMNs which
30 have incompatible radio interfaces due to e.g. different
frequencies of operation.

A significant drawback making international roaming
less appealing results from the charges of the
international calls. Conventionally, routing of a call
35 terminating at a roaming mobile station has not been

optimized, which may have caused unnecessary double international connections, resulting in very high international charges. To take an example, let us assume that a mobile station MS in Australia makes an international call to a mobile subscriber who has his home PLMN in Germany, but who is currently roaming in a visitor PLMN (VPLMN) in Australia. The calling mobile subscriber (A party) dials the directory number MSISDN (Mobile Station ISD Number) of the called mobile subscriber (B party). On the basis of the MSISDN, the call will be routed, unless optimal routing is used, to the home PLMN of the B party in Germany. Then, the home PLMN of the B party discovers that the B subscriber is currently roaming in Australia, and routes the call back to Australia. Consequently, two international connections have been established between Australia and Germany.

The calling party is typically charged of the routing to the home PLMN of the called party, i.e. the first leg of the routing, and the called party is charged of the second leg of the routing, from the home PLMN to the visitor PLMN. As a result, in this example, the called party has to pay high international charges for calls he does not at all want to receive. The call charges may also be distributed in another way between the calling and called parties. Nevertheless, high call charges do not encourage a mobile subscriber to employ roaming service to a wider extent. As a matter of fact, it is presumed that most mobile subscribers will have barring of incoming calls during roaming.

Thus, in conventional systems, an incoming call is usually always routed to the home network of the called subscriber, even if he were roaming abroad. However, ideas of optimal routing of incoming calls have recently evolved; in short, this means that the call will be routed directly from the PLMN where the A party currently is

located to the PLMN currently visited by the B party. Hence, it is possible to avoid additional international connections, or even manage without international connections in case the A and B parties are roaming within the same network. Figure 1 illustrates the latter case as an example of successful optimal routing.

In Figure 1, the A party, mobile station MS_A , makes a call to the B party, mobile station MS_B , whose home PLMN is different from the PLMN where the A party is located (A party PLMN). The A party visitor MSC, constituted by the mobile services switching center MSC and a visitor location register VLR related thereto, analyzes the MSISDN number dialled, and routes the call to a gateway MSC (GMSC) in the A party PLMN (step 1). The GMSC requests routing information from a home location register HLR in the home PLMN of the B party (step 2). The HLR, in turn, requests a roaming number from the VMSC in which the B party (MS_B) is currently roaming (step 3). In this description, the VMSC will be referred to as a B party VMSC. The B party VMSC allocates a Mobile Station Roaming Number (MSRN) for the call, and sends the MSRN back to the HLR (step 4) which sends it further to the GMSC in the A party PLMN (step 5). On the basis of the roaming number, the GMSC routes the call directly to the B party VMSC, which in this case is in the A party PLMN (step 6). Consequently, the call is an ordinary "local call" instead of two international calls.

In developing optimal routing, the principle adopted is that the A party GMSC decides whether to carry out optimal routing or not. The decision is made on the basis of the call charges payable by the A party, with the criterion that optimal routing may not increase the A party's call charges. In other words, optimal routing is only carried out in situations in which the call charges payable by the A party will be lower or the same as the

charges in case the call were routed in the normal manner, i.e. first to the B party home PLMN. For example, if a Finnish mobile subscriber calls a Swedish mobile subscriber, optimal routing will not be carried out if the Swedish mobile subscriber is roaming e.g. in Italy. On the other hand, optimal routing will be carried out if the Swedish mobile subscriber is roaming e.g. in Finland.

With the aforementioned optimized routing, in which the routing decision is made on the basis of the charges payable by the A subscriber, a new problem will be encountered: double allocation of roaming numbers in a situation in which optimal routing cannot be carried out. This situation is illustrated in Figure 2. The A party, mobile station MS_A , begins a call to the B party, mobile station MS_B . The A party PLMN is different from the B party home PLMN, and the B party is visiting a third PLMN, visitor PLMN. The A party VMSC routes the call to a GMSC in the A party PLMN (step 1), which requests routing information from the B party HLR, as in Figure 1. The HLR requests a roaming number from the B party VMSC (step 3), which allocates a roaming number MSRN for the call. The B party VMSC sends the MSRN to the HLR (step 4), which forwards it to the GMSC in the A party PLMN (step 5). The GMSC analyzes the roaming number which indicates that optimal routing directly to the visitor PLMN would increase the A party's phone bill. Due to this, the GMSC will not carry out optimal routing but routes the call to the GMSC of the B party home PLMN. This GMSC requests new routing information (step 7) from the HLR, which in turn causes a new roaming number request to the B party VMSC (step 8), allocation of a new MSRN and sending it to the HLR (step 9) and further to the GMSC (step 10). Following this, the GMSC routes the call (step 11) on the basis of the new roaming number. In this example, however, the roaming number requested by the first GMSC was not used

and therefore was allocated in vain. Such double allocation of roaming numbers for a single call wastes roaming numbers, at its worst doubling the required total number of them.

5 Disclosure of the Invention

It is an object of the present invention to prevent double allocation of roaming numbers in association with optimal routing.

10 This object is achieved with a method for routing a mobile-terminating call in a mobile communication system from a calling mobile station located in a first mobile communication network to a called mobile station whose home mobile communication network is different from said first network. According to the invention, the method is
15 characterized by the steps of

 requesting by the first mobile communication network a B party location information from the B party home network, the location information request causing no roaming number to be allocated for the call,

20 requesting by the first mobile communication network a routing information from the B party home network, if the first mobile communication network decides, on the basis of the location information received as a response to the location information request, to
25 carry out optimal call routing directly to the mobile communication network where the B party is roaming, the routing information request causing a roaming number to be allocated for the call,

 routing by the first mobile communication network
30 the call to the B party home network without the routing information request, if the first mobile communication network decides, on the basis of the location information received as a response to the location information request, not to carry out optimal call routing.

35 The present invention also relates to a method for

routing a mobile-terminating call in a mobile communication system from a calling mobile station located in a first mobile communication network to a called mobile station whose home mobile communication network is different from said first network, said method
5 comprising the steps of requesting by the GMSC of the first mobile communication network a routing information from the B party home network, the routing information request causing a roaming number to be allocated for the
10 call in the visitor MSC where the B party is roaming; and deciding by the GMSC of the first mobile communication network, on the basis of the roaming number, whether to carry out optimal call routing to the visitor MSC or normal routing to the B party home network, According to
15 the invention, the method is characterized by the step of activating by the GMSC of the first mobile communication network in the visitor MSC a release of the roaming number allocated for the call if optimal call routing is not carried out.

20 The invention also relates to arrangements according to claims 6 and 8 for routing a mobile-terminating call.

In the preferred embodiment of the invention, the aim is to prevent double allocation of roaming numbers by
25 the A party mobile communication network first requesting information on the location of the B party instead of requesting routing information from the B party home network, as in prior art. Only if it is detected, on the basis of this location information, that the call can be
30 optimally routed will the actual routing information request be carried out, which causes a roaming number to be allocated for the call. If it is decided that optimal routing be not carried out, but the call is routed to the B party home network, the routing information request will
35 not be carried out until at the home network.

According to the second embodiment of the invention, the A party mobile communication network requests routing information from the B subscriber home network, causing a roaming number to be allocated for the call, as in the prior art solution. According to the invention, the A subscriber mobile communication network thus causes release of the allocated roaming number, if it decides not to carry out optimal routing but routes the call to the home network.

10 **Brief Description of the Drawings**

In the following, the invention will be described in closer detail by means of exemplary embodiments, with reference to the accompanying drawings, in which

15 Figure 1 illustrates prior art optimal routing, with A and B parties located in the same PLMN,

Figure 2 illustrates prior art optimal routing, with the B party roaming in a third PLMN which is neither the A party PLMN nor the B party home PLMN,

20 Figure 3 illustrates optimal routing according to the preferred embodiment of the invention, with A and B parties located in the same PLMN,

Figure 4 illustrates optimal routing according to the preferred embodiment of the invention, with the B party roaming in a visitor PLMN which is different from the A party PLMN and the B party home PLMN,

25 Figure 5 illustrates routing according to the second embodiment of the invention, with the B party roaming in a visitor PLMN which is different from the A party PLMN or B party home PLMN.

30 **Preferred Embodiments of the Invention**

The present invention is especially well applicable for use in the European digital mobile communication system GSM (Global System for Mobile Communication) and a modification thereof, DCS1800 (Digital Communication System). However, the invention is not restricted to the

above systems, but it can be applied to other similar systems, such as the PCS1900 (Personal Communication System) in the United States.

5 In the following, the preferred embodiments of the invention will be described in association with the GSM system. It should be noted that the invention is not in any way restricted to this specific system.

10 The precise structure of the mobile communication system to which the invention is applied, or the routing procedure of mobile-terminating calls within the system are not significant as far as the present invention is concerned. Therefore, they are not described herein. For a description of the GSM system, the GSM recommendations and the "Global System for Mobile Communications", M. Mouly & M-B. Pautet, Palaiseau, France, 1992, ISBN: 2-9507190-0-7
15 are referred to.

In the above, prior art optimal routing of international calls was described with reference to Figures 1 and 2. The drawback in the prior art routing, as
20 mentioned above, is double allocation of roaming numbers.

In the preferred embodiment of the invention, the aim is to prevent double allocation of a roaming number so that the GMSC of the A party PLMN does not request routing information from the B party home PLMN as in Figures 1 and
25 2, but requests information on the location of the B party from the B party HLR. Only if the call can, on the basis of this information, be optimally routed with the charges payable by the A party being lower or equal in comparison to routing the call directly to the B party home PLMN does
30 the GMSC request the actual routing information (roaming number) from the B party HLR.

Figure 3 illustrates a situation where both the A party and the B party are in the same PLMN at the time the call is being established, that is, in the A party PLMN.
35 The A party, mobile station MS_A, begins the call, as in

Figures 1 and 2, by dialling the B party directory number MSISDN on the basis of which the A party VMSC routes the call to the GMSC in the A party PLMN (step 1). Following this, the GMSC requests the location of the B party from the B party home location register HLR (step 2). The HLR checks the B party location from the subscriber data, and transmits the location information to the GMSC (step 3). This location information may, for example, be the identifier of the country, PLMN or VMSC where the B party currently is located. The GMSC analyzes the location information received, and observes that optimal routing is possible as the A and B parties are in the same PLMN, signifying that the call charges payable by the A party will be lower than if routing took place to the B party home PLMN. As a result, the GMSC normally requests routing information (4) from the B party home PLMN, whereby the HLR requests a roaming number from the B party VMSC (step 5). The B party VMSC allocates a roaming number for the call, and sends it to the HLR (step 6) which returns it to the GMSC. On the basis of the roaming number, the GMSC carries out optimal routing, i.e. routes the call from the A party VMSC directly to the B party VMSC.

Figure 4 illustrates routing according to the preferred embodiment of the invention when the GMSC of the A party PLMN decides it cannot carry out optimal routing. The A party, mobile station MS_A , begins a call to the B party, mobile station MS_B , by dialling the B party directory number MSISDN. The A party VMSC forwards the call to the GMSC (step 1) which, according to the invention, requests location information from the B party HLR (step 2), as in Figure 3. The HLR checks the location of the B party from the subscriber data, and sends the location information to the GMSC (step 3), as in Figure 3. In the exemplary case, the location information is the identifier of the PLMN where the B party is roaming. In

this context, this PLMN is referred to as the B party visitor PLMN. The A party GMSC analyzes the location information received, and observes that to route the call optimally to the B party visitor PLMN directly would increase the charges payable by the A party higher than would to first route the call to the B party home PLMN. Thus, the GMSC of the A party PLMN routes the call to the GMSC of the B party home PLMN (step 4), and does not request routing information 4 illustrated in Figure 3. Hence, the A party GMSC does not cause a roaming number to be allocated for the call, either. Instead, the GMSC of the B party home PLMN requests routing information from the B party home HLR (step 5) which in turn requests the B party VMSC to allocate a roaming number (steps 6 and 7), and forwards the roaming number back to the GMSC of the home PLMN. On the basis of the roaming number, the GMSC routes the call forward to the B party VMSC (step 9). Consequently, only one roaming number will be allocated for the call, even though optimal routing is not used.

In the second embodiment of the invention, the A party GMSC requests routing information from the B party HLR, causing a roaming number to be allocated for the call, as in the prior art solution (cf. Figures 1 and 2), but causes release of a roaming number in the B subscriber VMSC if it decides not to route the call optimally. According to this embodiment, call set-up takes place in the same manner as in Figure 1 when optimal routing is carried out. Figure 5 illustrates a case where optimal routing is not carried out.

Figure 5 illustrates the same call establishment situation as Figures 2 and 4, i.e. call establishment from the A party to the B party who is roaming outside his home PLMN in a visitor PLMN, which is here referred to as a B party visitor PLMN. The B party visitor PLMN is different from the A party PLMN. In Figure 5, call establishment

steps 1, 2, 3, 4 and 5 are similar to those in Figure 2. In a response message 5, the A party GMSC obtains a roaming number from the B party HLR. On the basis of the roaming number, the A party GMSC makes the decision that optimal routing directly to the B party VMSC costs more for the A party than routing the call first to the B party home PLMN. Consequently, the A party GMSC does not carry out optimal routing but routes the call to the GMSC of the B party home PLMN (step 6), resulting in the same call establishment steps 7, 8, 9, 10 and 11 as in Figure 2. According to the invention, the A party GMSC transmits a command to the B party VMSC to release the roaming number first allocated for the call. This is illustrated by message 12 in Figure 5. This is possible because the roaming number is actually the B party VMSC address information on the basis of which the release command of the roaming number can be forwarded. The B party VMSC releases the roaming number indicated by release message 12. Release message 12 can be sent prior to routing the call to the home PLMN (step 6), or during the latter call establishment steps 6-11, or even following them. From the point of view of using roaming numbers, it is the more advantageous the earlier the roaming number can be released.

The drawings and the description related thereto are only intended to illustrate the present invention. The invention may vary in details within the scope and spirit of the attached claims.

30

35

Claims

1. A method for routing a mobile-terminating call in a mobile communication system from a calling mobile station located in a first mobile communication network to a called mobile station whose home mobile communication network is different from said first network, characterized by the steps of
- 5 requesting by the first mobile communication network a B party location information from the B party home network, the location information request causing no roaming number to be allocated for the call,
- 10 requesting by the first mobile communication network a routing information from the B party home network, if the first mobile communication network decides, on the basis of the location information received as a response to the location information request, to carry out optimal call routing directly to the mobile communication network where the B party is roaming, the
- 15 routing information request causing a roaming number to be allocated for the call,
- 20 routing by the first mobile communication network the call to the B party home network without the routing information request, if the first mobile communication network decides, on the basis of the location information received as a response to the location information request, not to carry out optimal call routing.
- 25 2. A method as claimed in claim 1, characterized by the steps of
- 30 requesting by the gateway mobile services switching center GMSC of the first mobile communication network the location of the B party from the home location register of the B party home network,
- 35 returning by the home location register of the B party a location information according to which the B

party is roaming outside the B party home network,

deciding by the GMSC of the first mobile communication network, on the basis of estimated call charges payable by the A party, whether to optimally route the call directly to the mobile communication network where the B party is roaming, or whether to route the call to the B party home network, and

if the GMSC of the first mobile communication network decides in favour of optimal routing,

(a) requesting by the GMSC of the first mobile communication network routing information from the B party home location register,

(b) requesting by the B party home location register a roaming number from the visitor MSC in which the B party is roaming,

(c) allocating by the visitor MSC a roaming number for the call, and transmitting it to the B party home location register,

(d) sending by the B party home location register the roaming number to the GMSC of the first mobile communication network,

(e) routing by the GMSC of the first mobile communication network the call to the visitor MSC on the basis of the roaming number, and

routing the call to the B party home network if the GMSC of the first mobile communication network decides not to carry out optimal routing.

3. A method as claimed in claim 1 or 2, characterized by said location information indicating the location of the mobile station within an accuracy of a country, mobile communication network, or MSC.

4. A method for routing a mobile-terminating call in a mobile communication system from a calling mobile station located in a first mobile communication network to

a called mobile station whose home mobile communication network is different from said first network, said method comprising the steps of

5 requesting by the GMSC of the first mobile communication network a routing information from the B party home network, the routing information request causing a roaming number to be allocated for the call in the visitor MSC where the B party is roaming; and

10 deciding by the GMSC of the first mobile communication network, on the basis of the roaming number, whether to carry out optimal call routing to the visitor MSC or normal routing to the B party home network, characterized by the step of

15 activating by the GMSC of the first mobile communication network in the visitor MSC a release of the roaming number allocated for the call if optimal call routing is not carried out.

5. A method as claimed in claim 4, characterized by the steps of

20 requesting by the GMSC of the first mobile communication network a routing information from the B party home location register,

25 requesting by the B party home location register a roaming number from the visitor MSC in which the B party is roaming,

allocating by the visitor MSC a roaming number for the call, and transmitting it to the B party home location register,

30 sending by the B party home location register the roaming number to the GMSC of the first mobile communication network,

35 deciding by the GMSC of the first mobile communication network, on the basis of estimated call charges payable by the A party, whether to optimally route the call directly to the mobile communication network

where the B party is roaming, or whether to route the call to the B party home network,

5 sending by the GMSC of the first mobile communication network a command to release the roaming number allocated for the call in the visitor MSC, if optimal routing is not carried out.

10 6. An arrangement for routing a mobile-terminating call in a mobile communication system from a calling mobile station (MS_A) located in a first mobile communication network to a called mobile station (MS_B) whose home mobile communication network is different from said first network, characterized in that

15 the GMSC of the first mobile communication network is arranged to request B party location information from the B party home network, the location information request causing no roaming number to be allocated for the call,

20 the GMSC of the first mobile communication network is arranged to request routing information from the B party home network, if the first mobile communication network decides, on the basis of the location information received as a response to the location information request, to carry out optimal call routing directly to the mobile communication network where the B party is roaming, the routing information request causing a roaming number

25 to be allocated for the call,

30 the GMSC of the first mobile communication network is arranged to route the call to the B party home network without the routing information request, if the first mobile communication network decides, on the basis of the location information received as a response to the location information request, not to carry out optimal call routing.

35 7. A method as claimed in claim 6, characterized by said location information indicating the location of the mobile station within an

accuracy of a country, mobile communication network, or MSC.

8. An arrangement for routing a mobile-terminating call in a mobile communication system from a calling mobile station (MS_A) located in a first mobile communication network to a called mobile station (MS_B) whose home mobile communication network is different from said first network, in which arrangement

the GMSC of the first mobile communication network is arranged to request routing information from the B party home network, the routing information request causing a roaming number to be allocated for the call in the visitor MSC (VMSC) where the B party is roaming,

the GMSC of the first mobile communication network is arranged to decide on the basis of the roaming number whether to carry out optimal call routing to the visitor MSC (VMSC) or a normal routing to the B party home network, characterized in that

the GMSC of the first mobile communication network is arranged to activate in the visitor MSC (VMSC) release of the roaming number allocated for the call if optimal call routing is not carried out.

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Fig. 1

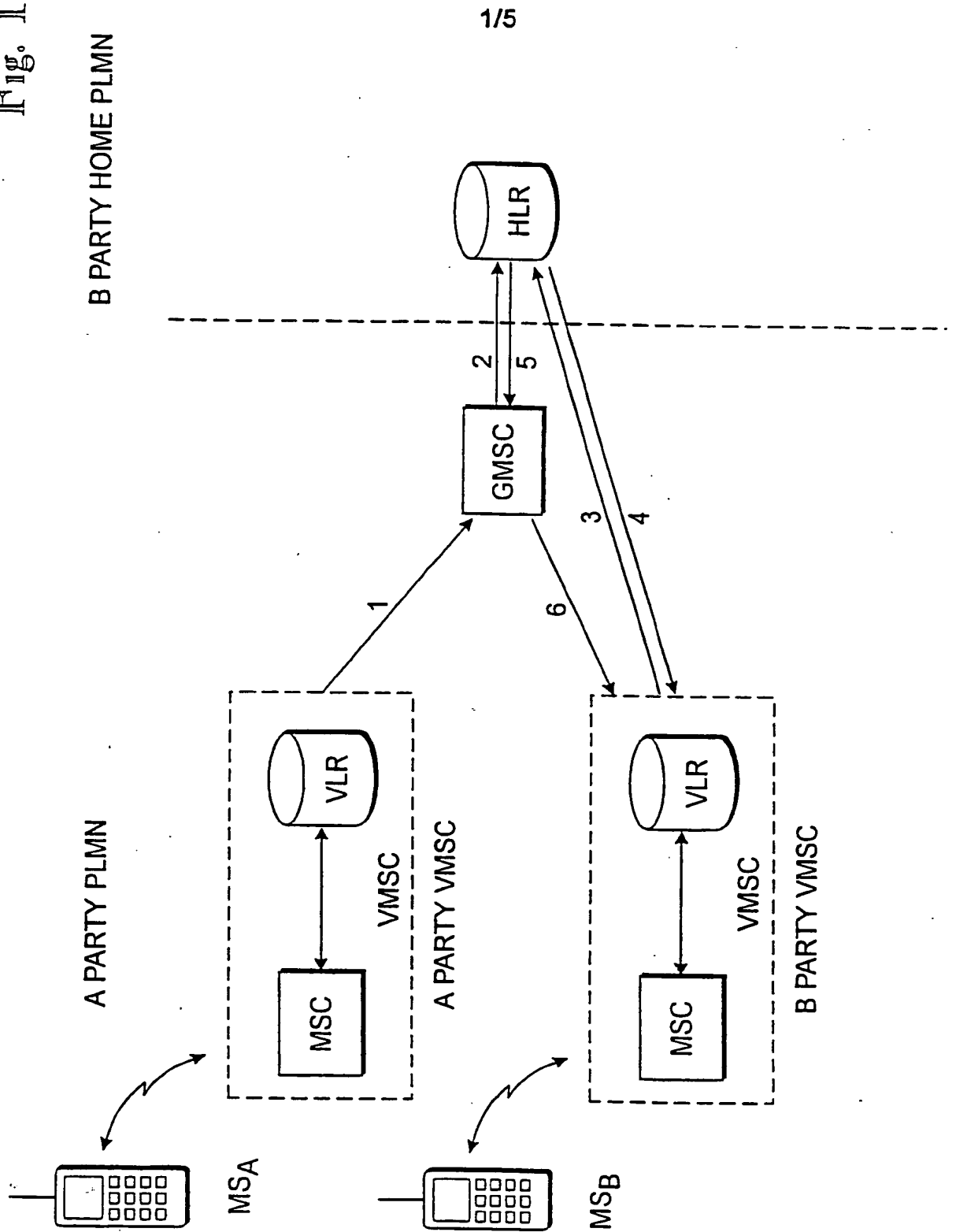


Fig. 2

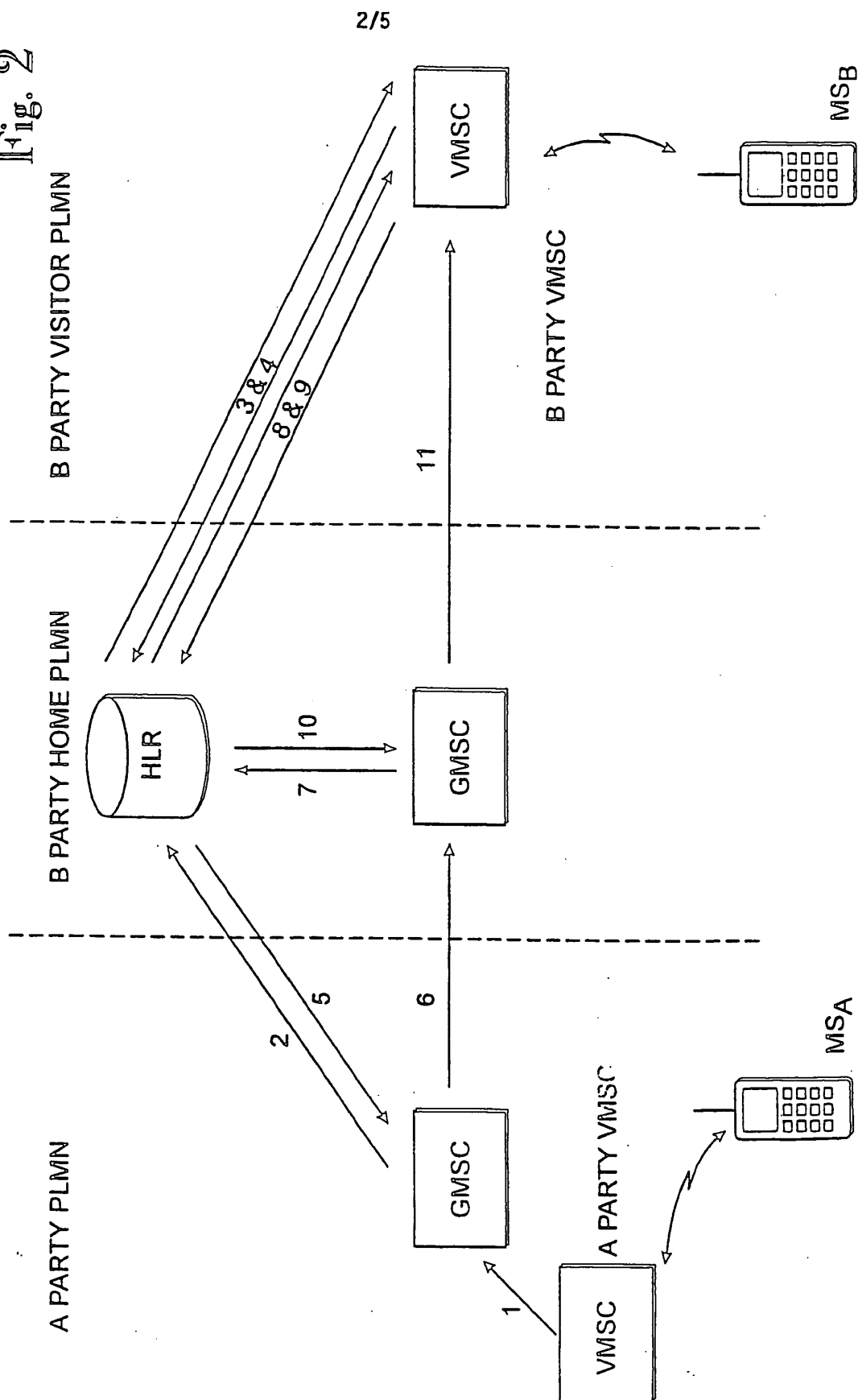
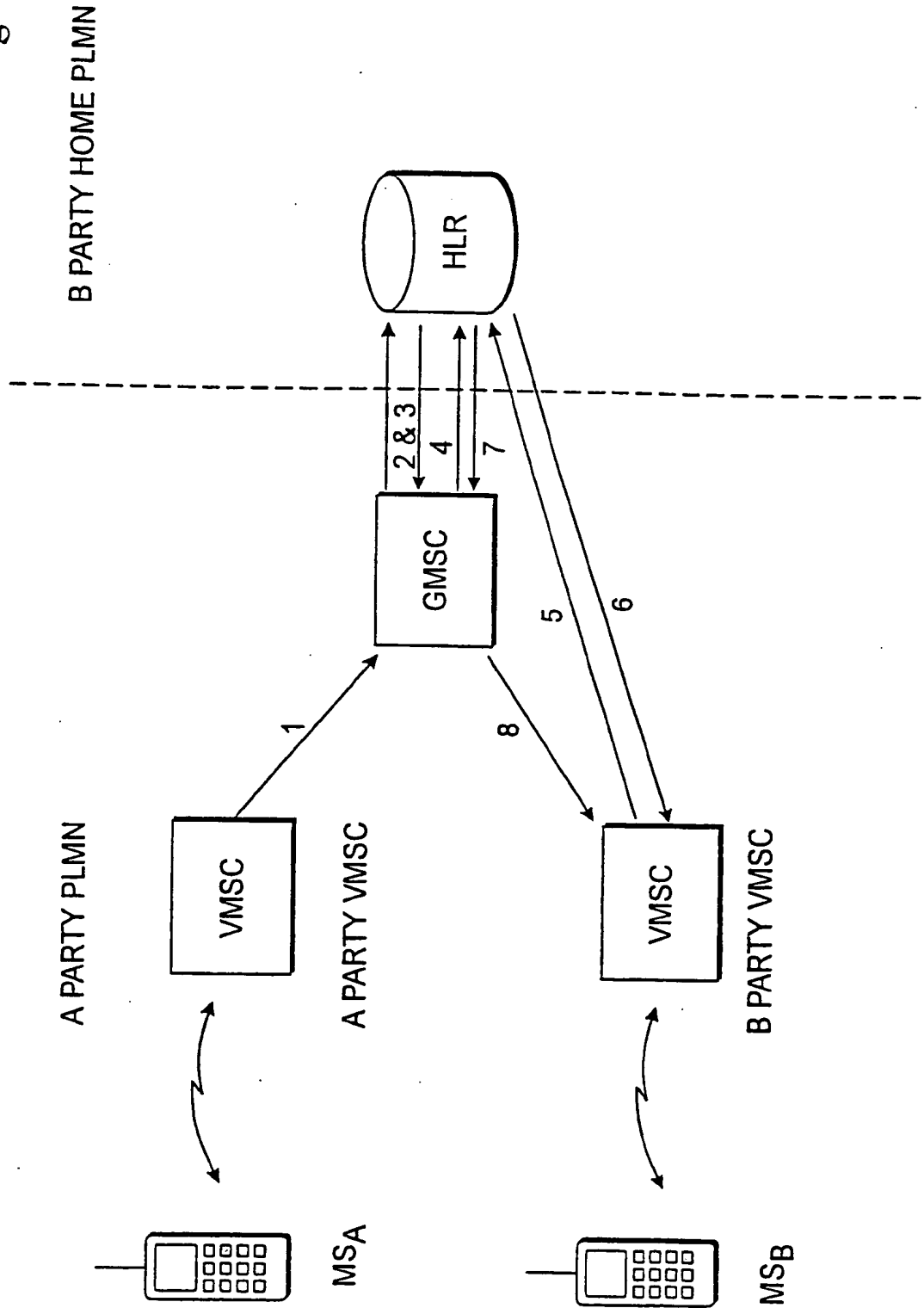
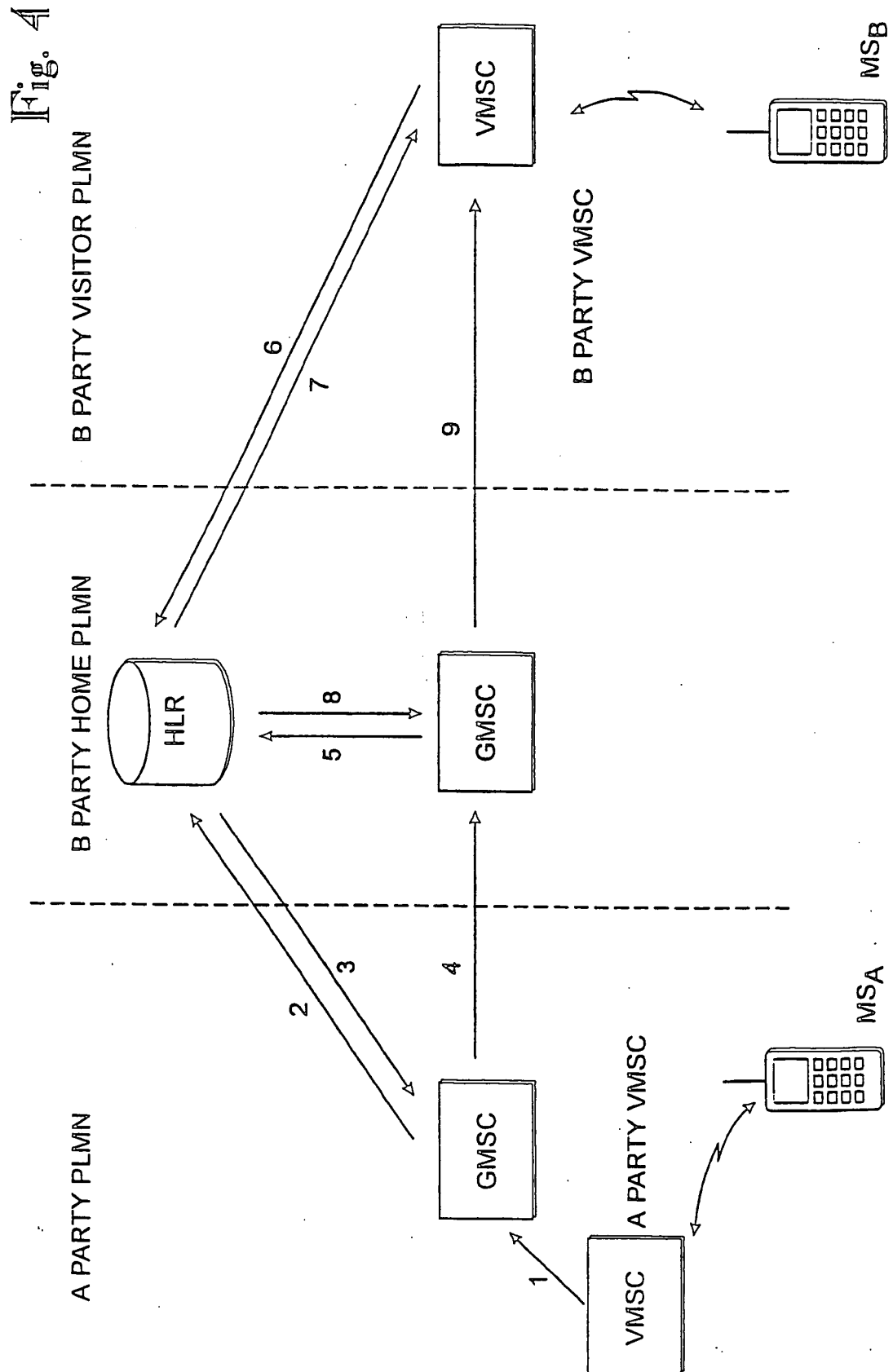


Fig. 3

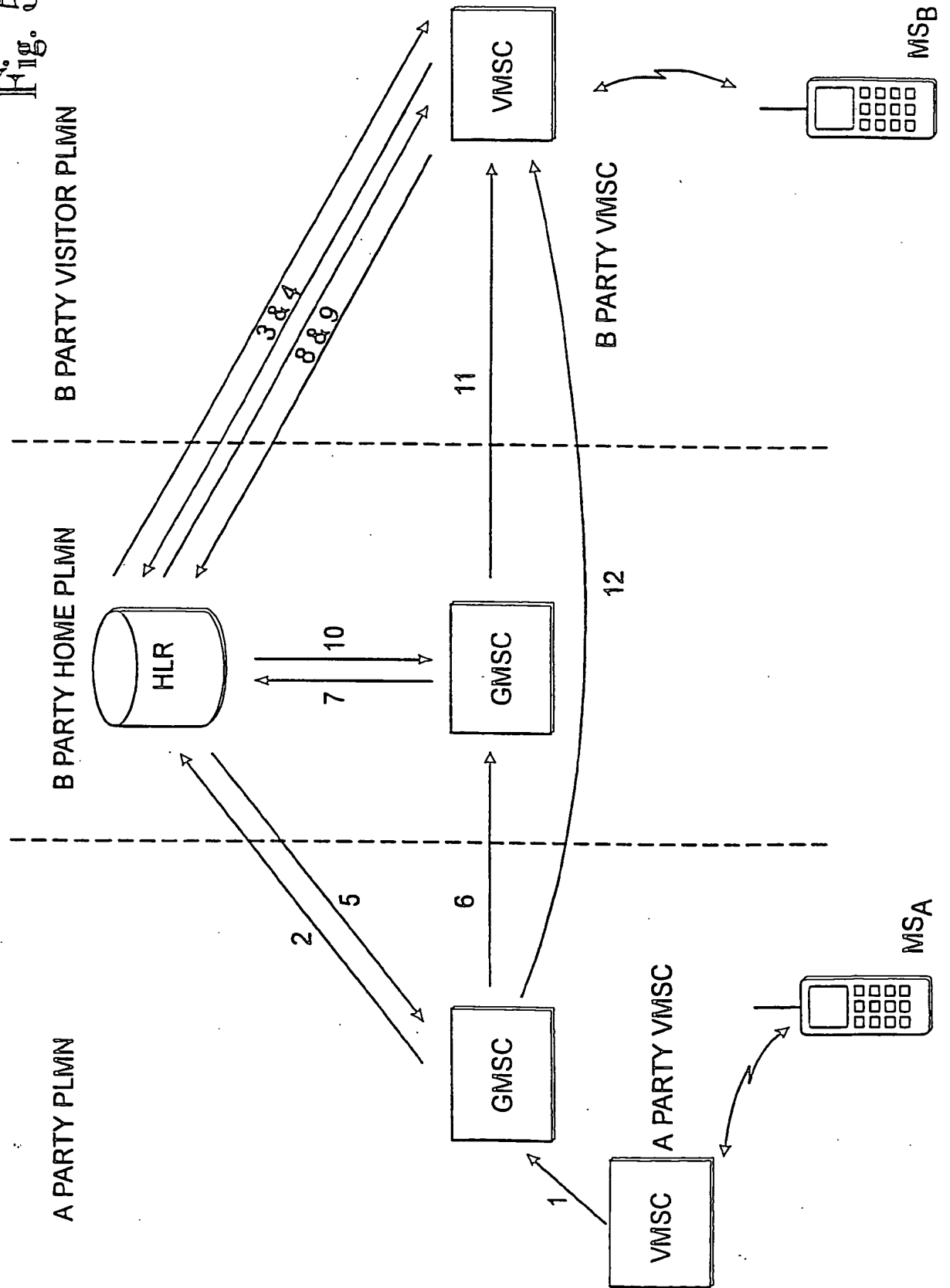
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Fig. 5



INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 96/00447

A. CLASSIFICATION OF SUBJECT MATTER		
IPC6: H04Q 7/38, H04Q 7/22 According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED		
Minimum documentation searched (classification system followed by classification symbols)		
IPC6: H04Q		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
SE,DK,FI,NO classes as above		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5353340 A (D.P. KUNZ), 4 October 1994 (04.10.94), column 3, line 30 - column 4, line 10; column 5, line 29 - column 6, line 26 --	4-5,8
A	WO 9421090 A1 (TELEFONAKTIEBOLAGET LM ERICSSON), 15 Sept 1994 (15.09.94), page 4, line 20 - page 6, line 5 --	1-3,6-7
P,A	EP 0675663 A2 (SIEMENS AKTIENGESELLSCHAFT), 4 October 1995 (04.10.95), column 5, line 18 - column 6, line 30 --	1-8
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search		Date of mailing of the international search report
7 February 1997		10 -02- 1997
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86		Authorized officer Christina Halldin Telephone No. +46 8 782 25 00

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI96/00447

Box I Observations where certain claims were found unsearchable (Continuation of Item 1 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of Item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see extra sheet

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☒ As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest.
☐ No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 96/00447

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P, A	WO 9620574 A1 (NOKIA TELECOMMUNICATIONS OY), 4 July 1996 (04.07.96), page 4, line 31 - page 7, line 20 -- -----	1-8

The invention claimed in claims 1-8 is considered to involve two groups of inventions:

I. Claims 1-3, 6-7. A method and an arrangement for routing a mobile-terminating call in a mobile communication system from a calling mobile station located in a first mobile communication network to a called mobile station whose home mobile communication system is different from the first network. The first mobile communication network requests a B party location information from the B party home network, the location information request causes no roaming number to be allocated. The location information is used to decide whether optimal routing will be carried out or not.

II. Claims 4-5, 8. A method and an arrangement for routing a mobile-terminating call in a mobile communication system from a calling mobile station located in a first mobile communication network to a called mobile station whose home mobile communication system is different from the first network. The GMSC of the first mobile communication network requests a routing information from the B party home network, the routing information request causes a roaming number to be allocated. The roaming number is used to decide whether optimal routing will be carried out or not. The roaming number is released if optimal routing is not carried out.

These inventions are two different solutions to prevent double allocation of roaming numbers in association with optimal routing.

These inventions are not so linked as to form a single general inventive concept (Rule 13.1). The inventions are not considered to involve one or more technical features, over the prior art, to fulfil the requirement of unity of invention (Rule 13.2).

INTERNATIONAL SEARCH REPORT

28/10/96

International application No.

PCT/FI 96/00447

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 5353340	04/10/94	AT-T- 128311	15/10/95
		AU-B- 649662	02/06/94
		AU-A- 7461891	10/10/91
		DE-D,T- 69113190	28/03/96
		EP-A,B- 0474812	18/03/92
		SE-T3- 0474812	
		ES-T- 2080302	01/02/96
		JP-T- 5500593	04/02/93
		WO-A- 9114349	19/09/91
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		JP-T- 7506710	20/07/95
		NO-A- 950837	03/03/95
		SE-C- 501009	17/10/94
		SE-A- 9300721	05/09/94
		US-A- 5467381	14/11/95
EP-A2- 0675663	04/10/95	NONE	
WO-A1- 9620574	04/07/96	AU-A- 1371595	19/07/96